Absences from Work and Beryllium Sensitization among Workers at the Department of Energy

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Main study question:

Are beryllium sensitization (BeS) and chronic beryllium disease (CBD) associated with increased absences from work?

Unique basis for quantitative investigation:

- Illness and Injury Surveillance Program (IISP)
- Beryllium-Associated Worker Registry (BAWR)

IISP and BAWR

- Administered by DOE and maintained at ORAU
- Annual database records stored by same unique pseudo-identifiers

IISP

- From pilot program in the 1980s to 14 sites by 2011
- Occupational health and demographic data in database
  - Absences from work and medical reasons for absence included

BAWR

- Established by federal mandate in 2002 with 28 sites by 2011
- Medical and beryllium exposure information in database
  - Beryllium status of LPT-normal, BeS, or CBD included

Three-pronged approach for main analysis:

1. Percent absent by final Be status (descriptive analysis)
2. Time to first 5-day absence for BeS/CBD versus LPT-normal (survival analysis)
3. Odds ratios based on every absence for BeS/CBD versus LPT-normal (logistic regression)

Methods for Main Analysis

- Study group: 19,305 beryllium workers from 12 DOE sites who also had de-identified records in the IISP
  - 130,414 person-years
- Time period: 2002-2011
- Outcomes for analyses:
  - All absences combined
  - Respiratory absences (ICD-9-CM codes 460-519)

Secondary Analysis

- Literature shows machinists and jobs with similar tasks more likely to become BeS or CBD than other workers
- Line operators and crafts have highest potential for Be exposure
- Examine OR by line operators and crafts versus others for BeS/CBD outcome since job titles not available

Descriptive Analysis by Final Be Status

- Group 1: Stayed LPT-normal
  - 18,867 workers (97.7%) and 97.3% of person-years
- Group 2: BeS but no CBD
  - 324 workers (1.7%) and 2.0 % of person-years
- Group 3: Diagnosed with CBD
  - 114 workers (0.6%) and 0.7 % of person-years

Comparing Percentages of Absences

Based on Absence Person-years (Pyrs) within Group

	All absences		Respiratory absences	
	Absence Pyrs	% of Group (95% CI)	Absence Pyrs	% of Group (95% CI)
Group 1	20,592	16.2 (15.7,16.7)	3,962	3.1 (2.6,3.7)
Group 2	484	18.6 (15.3,22.4)	80	3.1 (0.7,10.4)
Group 3	208	24.5 (18.9,31.0)	74	8.7 (3.7,18.2)

Comparing Occupational Group (OccGrp)

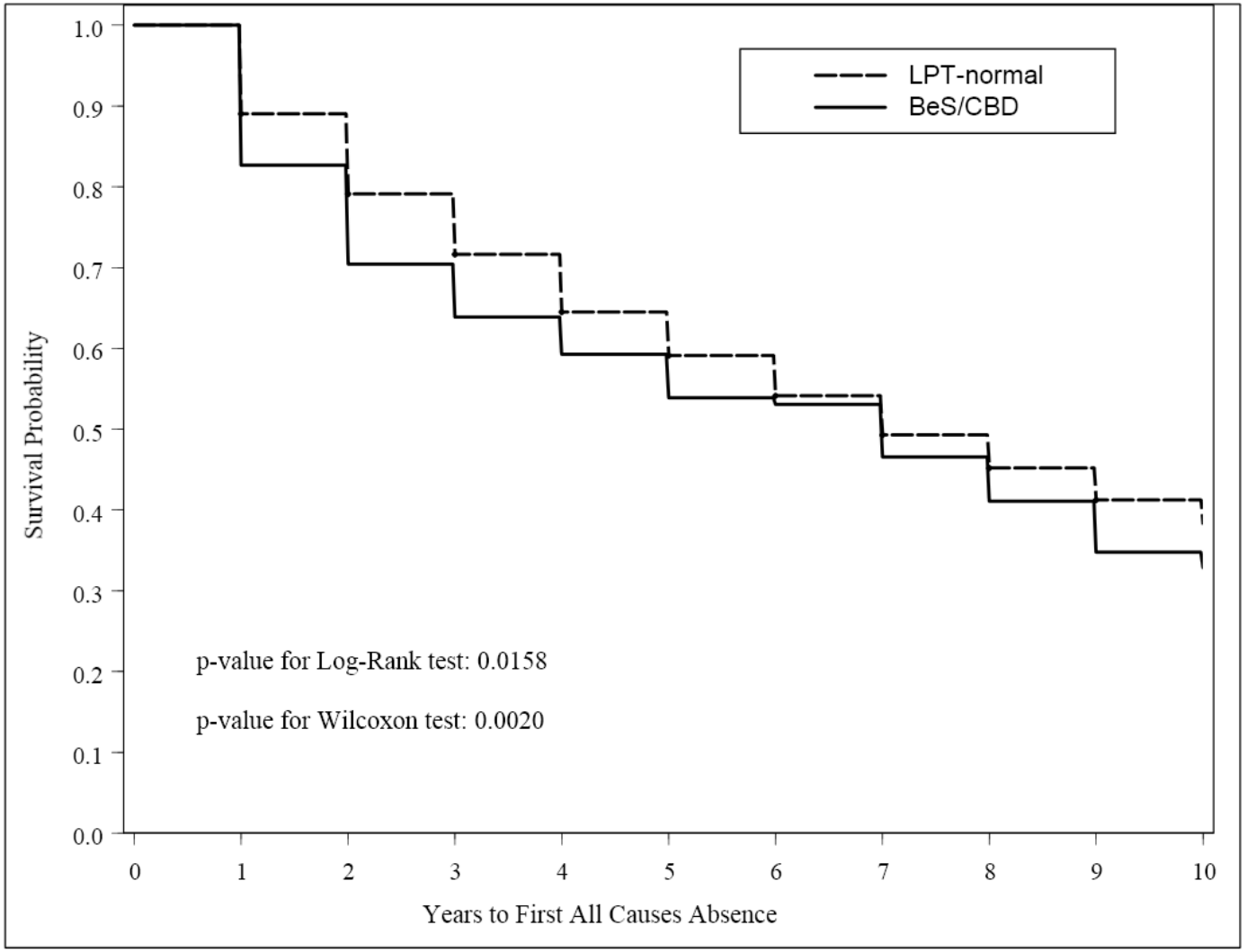
Person-years (Pyrs) by Annual Be-Status

Beryllium Status	OccGrp Total		BeS / CBD	
OccGrp	Pyrs	% of Total	Pyrs	% of OccGrp
Admin Support	8,282	6.4	151	1.8
Crafts	24,923	19.1	516	2.1
Security and Fire	5,488	4.2	79	1.4
Line Operators	14,127	10.8	263	1.9
Professional	42,269	32.4	631	1.5
Service	10,436	8.0	167	1.6
Tech Support	24,889	19.1	307	1.2
Total	130,414		2,114	

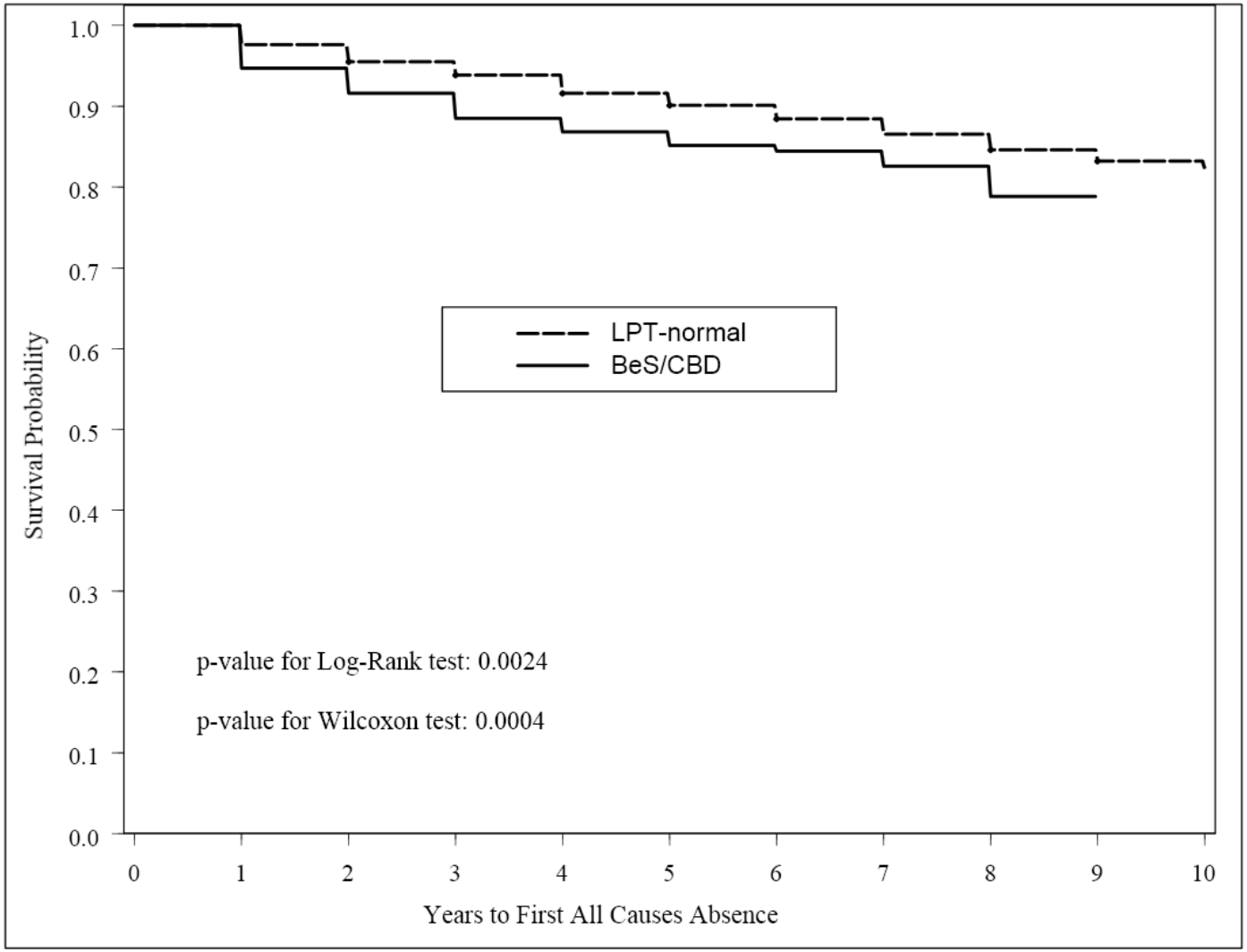
Survival Analysis

- Each worker contributed at most one absence
- Plots by BeS/CBD versus LPT-normal strata
- Statistical difference between strata tested by Log-Rank and Wilcoxon tests

Product-Limit Survival Estimates for Years to First All Cause Absence Stratified by Be Status



Product-Limit Survival Estimates for Years to First Respiratory Absence Stratified by Be Status



Logistic Regression Analysis

- Worker could contributed multiple events assigned to appropriate strata
- Statistical difference presented by 95% confidence intervals on odds ratios

Adjusted Odds Ratios

Odds Ratios for BeS/CBD versus LPT-normal		
Outcome	Odds Ratio	95% Confidence Interval
All causes absence	1.31	1.18, 1.46
Respiratory absence	1.51	1.24, 1.84
Odds Ratio for Line operators/Crafts versus Others		
BeS/CBD	1.36	1.25, 1.49

Summary of Statistical Results

- Log-rank and Wilcoxon tests found significantly shorter times to first absence for BeS/CBD versus LPT-normal stratum.
- Odds ratios for the BeS/CBD stratum were statistically significantly elevated for all and respiratory absences outcomes.
- Odds ratio for line operators/crafts compared to other occupational groups was statistically significantly elevated for a BeS/CBD outcome.

Conclusions

- Absences in workers who were beryllium sensitized or had CBD were elevated compared to coworkers having normal LPTs.
- Line operators/crafts workers were more likely to become beryllium sensitized or have CBD than workers performing other job tasks.
- Based on maximum 10-year follow-up (2002-2011)

Your Turn

- Questions for me?

- Discussion topic:
  - What are the practical implications of the results of this investigation?